WHAT IS CLAIMED IS:

1. A wireless communication receiver comprising:
an antenna structure which acquires dimensionally differentiated signals;
a joint searcher and channel estimator which essentially concurrently considers the dimensionally differentiated plural signals provided by the plural antennas for determining both a time of arrival and channel coefficient.

2. The apparatus of claim 1, wherein the joint searcher and channel estimator essentially concurrently considers the dimensionally differentiated plural signals provided by the plural antennas for determining plural times of arrival and plural channel coefficients, an arriving wavefront being represented by one of the plural times of arrival and a corresponding one of the plural channel coefficients.

3. The apparatus of claim 1, wherein the antenna structure comprises an array of plural antennas, and wherein the signals acquired by different antennas of the array are dimensionally differentiated with regard to a spatial dimension.

4. The apparatus of claim 3, wherein the time of arrival and the channel coefficient are essentially concurrently determined by the joint searcher and channel estimator.

5. The apparatus of claim 4, wherein the time channel coefficient is a composite channel coefficient which takes into consideration channel impulse responses for channels associated with each of the plural antennas in the antenna array.

6. The apparatus of claim 3, wherein the antenna array comprises a uniform linear array of plural antennas.

7. The apparatus of claim 1, wherein the antenna structure comprises an antenna which provides signals for each of successive sets of pilot data received by the antenna as the dimensionally differentiated signals, whereby the signals acquired by the antenna are dimensionally differentiated with regard to a temporal dimension.

8. The apparatus of claim 1, further comprising a detector which utilizes the channel coefficient and the time of arrival to provide a symbol estimate.

9. The apparatus of claim 1, wherein the wireless communication receiver is a mobile terminal.

10. The apparatus of claim 1, wherein the wireless communication receiver is a network node.

11. The apparatus of claim 1, wherein the joint searcher and channel estimator comprises:

an antenna signal matrix in which complex values indicative of the dimensionally differentiated signal received in a sampling window are stored as a function of a sampling window time index and a dimensional differentiation index;

a correlator which locates value(s) in the antenna signal matrix for use in determining the time of arrival and the channel coefficient;

an analyzer which uses the value(s) located by the correlator to generate the time of arrival and the channel coefficient.

12. The apparatus of claim 11, wherein in locating the values the correlator considers a dimensional reception vector formed from the antenna signal matrix with respect to a sampling window time index, the dimensional receptivity vector having a frequency related to a difference between phase components of complex values of the dimensional receptivity vector, there being plural possible frequencies for the dimensional receptivity, the plural possible frequencies being represented by a frequency index; and

wherein for each combination of plural possible frequencies and plural time indexes, the correlator calculates:

$Y(n,t) = FFT(n,X(:,t))$

wherein t is the sampling window time index;

X(:,t) is the complex antenna matrix, with : representing all antenna indexes for one sampling window time index;

n is the frequency index.

13. The apparatus of claim 12, wherein for each combination of plural possible frequencies and plural time indexes, the correlator calculates:

$Y(n,t) = \Sigma\, C_j * FFT(n,X(:,t)),\ j = 1,K$

wherein C_j is a coding sequence symbol value j and K is a length of the coding sequence.

14. The apparatus of claim 12, wherein the antenna structure comprises an array of plural antennas, and wherein each of the plural possible frequencies for the dimensional receptivity vector represents a different possible direction of arrival of the arriving wavefront.

15. The apparatus of 14, wherein the correlator output comprises Y(n,t), and wherein the analyzer determines a maximum absolute value $|Y(n,t)|_{max}$, wherein the analyzer uses the a sampling window time index t_max at which $|Y(n,t)|_{max}$ occurs as the time of arrival of the arriving wavefront; and wherein the analyzer uses the a frequency index n_max at which $|Y(n,t)|_{max}$ occurs as the direction of arrival of the arriving wavefront.

16. The apparatus of 14, wherein the correlator output comprises Y(n,t), and wherein the analyzer determines a maximum absolute value $|Y(n,t)|_{max}$, wherein the analyzer obtains an amplitude for the arriving wavefront by dividing $|Y(n,t)|_{max}$ by a number of antennas comprising the antenna array.

17. The apparatus of claim 12, wherein the antenna structure comprises an antenna which provides signals for each of successive sets of pilot data received by the antenna as the dimensionally differentiated signals, and wherein each of the plural possible frequencies corresponds to a doppler shift.

18. The apparatus of 17, wherein the correlator output comprises Y(n,t), and wherein the analyzer determines a maximum absolute value $|Y(n,t)|_{max}$, wherein the analyzer uses a sampling window time index t_max at which $|Y(n,t)|_{max}$ occurs to determine the time of arrival of an arriving wavefront; and wherein the analyzer uses the a frequency index n_max at which $|Y(n,t)|_{max}$ to determine the doppler shift.

19. The apparatus of 17, wherein the correlator output comprises Y(n,t), and wherein the analyzer determines a maximum absolute value $|Y(n,t)|_{max}$, wherein the analyzer obtains an amplitude for an arriving wavefront by dividing $|Y(n,t)|_{max}$ by a number of sets of pilot data in the series.

20. The apparatus of claim 1, wherein the joint searcher and channel estimator comprises:

an antenna signal matrix in which complex values indicative of the dimensionally differentiated signal received in a sampling window are stored as a function of a sampling window time index and a dimensional differentiation index;

a parametric estimator which uses complex values in the antenna matrix and generates a parametric output estimation vector;

an analyzer which uses the parametric output estimation vector to generate the time of arrival and the channel coefficient.

21. The apparatus of claim 20, wherein the antenna structure comprises an array of plural antennas, and wherein each spatial frequency parameter in the parametric output estimation vector corresponds to a possible direction of arrival.

22. The apparatus of claim 20, wherein the analyzer uses absolute values of elements of the parametric output estimation vector to determine the time of arrival and direction of arrival of the arriving wavefront.

23. The apparatus of claim 22, wherein the parametric output estimation vector has a sampling window time index and a direction index; and wherein for an element of the parametric output estimation vector having a sufficiently high absolute value

24. The apparatus of claim 20, wherein the antenna structure comprises an antenna which provides signals for each of successive sets of pilot data received by the antenna as the dimensionally differentiated signals, and wherein each spatial frequency parameter corresponds to a possible doppler shift.

25. The apparatus of claim 21, wherein the parametric output estimation vector has a sampling window time index and wherein the analyzer uses absolute values of

elements of the parametric output estimation vector to determine the time of arrival and doppler shift of an arriving wavefront.

26. The apparatus of claim 25, wherein the parametric estimate output vector has a sampling window time index and wherein for an element of the parametric estimate output vector having a sufficiently high absolute value the analyzer uses the sampling window time index for an element of the parametric output estimation vector having a sufficiently high absolute value to determine the time of arrival of the arriving wavefront

27. A method of operating a wireless communication receiver comprising:
acquiring dimensionally differentiated signals at an antenna structure;
concurrently using the dimensionally differentiated signals for determining both a time of arrival and channel coefficient.

28. The method of claim 27, wherein the antenna structure comprises an array of plural antennas, and further comprising acquiring the dimensionally differentiated signals from different antennas of the array whereby the signals are dimensionally differentiated with regard to a spatial dimension.

29. The method of claim 28, further comprising essentially concurrently determining the time of arrival and the channel coefficient using a joint searcher and channel estimator.

30. The method of claim 29, wherein the time channel coefficient is a composite channel coefficient which takes into consideration channel impulse responses for channels associated with each of the plural antennas in the antenna array.

31. The method of claim 28, further comprising acquiring the dimensionally differentiated signals from a uniform linear array of plural antennas.

32. The method of claim 27, further comprising receiving, at an antenna of the antenna structure, signals for each of successive sets of pilot data received by the antenna as the dimensionally differentiated signals, whereby the signals acquired by the antenna are dimensionally differentiated with regard to a temporal dimension.

33. The method of claim 27, further comprising using a detector which utilizes the channel coefficient and the time of arrival to provide a symbol estimate.

34. The method of claim 27, further comprising

storing, in an antenna signal matrix, complex values indicative of the dimensionally differentiated signals received in a sampling window as a function of a sampling window time index and a dimensional differentiation index;

locating value(s) in the antenna signal matrix for use in determining the time of arrival and the channel coefficient;

using the value(s) located to generate the time of arrival and the channel coefficient.

35. The method of claim 34, the step of locating the values further comprises using a dimensional reception vector formed from the antenna signal matrix with respect to a sampling window time index, the dimensional receptivity vector having a frequency related to a difference between phase components of complex values of the dimensional receptivity vector, there being plural possible frequencies for the dimensional receptivity, the plural possible frequencies being represented by a frequency index; and

wherein for each combination of plural possible frequencies and plural time indexes, calculating:

$Y(n,t) = FFT(n,X(:,t))$

wherein t is the sampling window time index;

$X(:,t)$ is the complex antenna matrix, with : representing all antenna indexes for one sampling window time index;

n is the frequency index.

36. The method of claim 35, wherein for each combination of plural possible frequencies and plural time indexes, calculating:

$Y(n,t) = \Sigma\ C_j *FFT(n,X(:,t)),\ j = 1,K$

wherein C_j is a coding sequence symbol value j and K is a length of the coding sequence.

37. The method of claim 35, wherein the antenna structure comprises an array of plural antennas, and wherein each of the plural possible frequencies for the

dimensional receptivity vector represents a different possible direction of arrival of the arriving wavefront.

38. The method of claim 37, further comprising in the locating step generating an output which comprises Y(n,t), and further comprising determining a maximum absolute value $|Y(n,t)|_{max}$, using the a sampling window time index t_max at which $|Y(n,t)|_{max}$ occurs as the time of arrival of the arriving wavefront; and using the a frequency index n_max at which $|Y(n,t)|_{max}$ occurs as the direction of arrival of the arriving wavefront.

39. The method of claim 37, further comprising in the locating step generating an output which comprises Y(n,t), and further comprising:

determining a maximum absolute value $|Y(n,t)|_{max}$; and

obtaining an amplitude for the arriving wavefront by dividing $|Y(n,t)|_{max}$ by a number of antennas comprising the antenna array.

40. The method of claim 35, wherein the antenna structure comprises an antenna which provides signals for each of successive sets of pilot data received by the antenna as the dimensionally differentiated signals, and wherein each of the plural possible frequencies corresponds to a doppler shift.

41. The method of claim 40, wherein the locating step further comprises generating an output which comprises Y(n,t), and further comprising:

determining a maximum absolute value $|Y(n,t)|_{max}$;

using a sampling window time index t_max at which $|Y(n,t)|_{max}$ occurs to determine the time of arrival of an arriving wavefront; and

using the a frequency index n_max at which $|Y(n,t)|_{max}$ to determine the doppler shift.

42. The method of claim 40, wherein the locating step further comprises generating output comprising Y(n,t), and further comprising:

determining a maximum absolute value $|Y(n,t)|_{max}$; and

obtaining an amplitude for an arriving wavefront by dividing $|Y(n,t)|_{max}$ by a number of sets of pilot data in the series.

43. The method of claim 27, further comprising:

storing, in an antenna signal matrix, complex values indicative of the dimensionally differentiated signals received in a sampling window as a function of a sampling window time index and a dimensional differentiation index;

forming a parametric estimate using complex values in the antenna matrix and generating a parametric output estimation vector;

using the parametric output estimation vector to generate the time of arrival and the channel coefficient.

44. The method of claim 43, wherein the antenna structure comprises an array of plural antennas, and wherein spatial frequency parameter corresponds to a possible direction of arrival.

45. The method of claim 43, further comprising using absolute values of elements of the parametric output estimation vector to determine the time of arrival and direction of arrival of the arriving wavefront.

46. The method of claim 45, wherein the parametric output estimation vector has a sampling window time index and wherein for an element of the parametric output estimation vector having a sufficiently high absolute value the method further comprises:

using a sampling window time index for an element of the parametric output estimation vector having a sufficiently high absolute value to determine the time of arrival of the arriving wavefront.

47. The method of claim 43, wherein the antenna structure comprises an antenna which provides signals for each of successive sets of pilot data received by the antenna as the dimensionally differentiated signals, wherein the parametric output estimation vector has spatial frequency parameters, and wherein each spatial frequency parameter corresponds to a possible doppler shift.

48. The method of claim 44, wherein the parametric output estimation vector has a sampling window time index and further comprising using absolute values of elements of the parametric output estimation vector to determine the time of arrival and doppler shift of an arriving wavefront.

49. The method of claim 48, wherein the parametric output estimation vector has a sampling window time index and wherein for an element of the parametric output estimation vector having a sufficiently high absolute value the method further comprises using the sampling window time index for an element of the parametric output estimation vector having a sufficiently high absolute value to determine the time of arrival of the arriving wavefront.